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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 10/824,107
Filing Date: April 14, 2004
Appellant(s): DUESCHER, WAYNE O.

MAILED
DEC 17 2007
GROUP 1700

Mark A. Litman (Reg. No. 26,390)
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed October 25, 2007 appealing from the Office action mailed December 29, 2006.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is substantially correct. The changes are as follows:

In view of Applicants claim amendments submitted in the After Final amendment dated April 4, 2007, the rejection of claim 9 under 35 U.S.C. 112, first paragraph for containing subject material not adequately disclosed in the specification as originally filed has been withdrawn by the Examiner. All other rejections, namely bullets 2) through 9) on pages 12 and 13 of the instant Appeal Brief, stand as originally presented.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

5,984,988	BERG	11-1999
3,916,584	HOWARD	11-1975
4,393,021	EISENBERG	07-1983
6,521,004	CULLER	02-1983
3,838,998	MATTHEWS	10-1974
5,834,569	RAMANATH	10-1998

- Quadro Engineering Incorporated "Quadro Comi" product description (http://www.quadro.com/3_millig/3_applications.asp). Accessed July 6, 2006
- Cai, Shu-Hui et. al., "Atomic scale mechanism of the transformation of gamma-alumina to theta-alumina", Phys. rev. Lett., 2002; 89 (23):235501

- Zhai et. al., "Influence of rheological behavior of aqueous Al2O3/Nano-TiO2 slurry on the characteristics of powders prepared by spray pelletization", Materials Science and Engineering A 392 (2005) pp1-7

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 2, 3, 6, 8, 11, 12, 15, and 17 are rejected under 35 U.S.C. 102(b) as being anticipated by Berg (5,984,988). Briefly, berg teaches a method of manufacturing abrasive particles having specific, pre-determined shapes.

Specifically with respect to Claim 2 Berg teaches;

1. "Providing a mold having a first surface having an opening to a mold cavity having a specified shape" (Column 2, Lines 57-58). Further, said mold should have "at least one cavity, preferably a plurality of cavities"(C6, L1-3), and should be made from a relatively thin aluminum or stainless steel

sheet or belt" (C6, L6-9). It is here understood that the mold as described by Berg is equivalent to the "Cell Sheet" in the immediate claim and that the "plurality" of cavity is equivalent to the claimed array of "cell sheet through holes" which are further understood to inherently present a "cross sectional area". Further, the reference to the mold as being relatively thin indicates that said mold has a "nominal thickness". The cavities having both a thickness and cross sectional area, inherently define a "cell sheet volume" by the product of the two aforementioned values.

2. "preparing a dispersion containing particles that can be converted into alpha alumina in a liquid, which liquid comprises a volatile component, preferably water" (C4, L55-57) and the particles are preferably alpha aluminum oxide monohydrate (boehmite) (C4, L65-66). The described dispersion is hereby understood as equivalent to the claimed "liquid mixture solution" which is contains by an inorganic oxide, present as aluminum oxide monohydrate in the immediate context, and water.

3. "introducing the dispersion into cavities" (C6, L48-50) which is understood to be equivalent to filling the through holes with the liquid mixture solution to form a mixture volume. Berg later makes reference to the "filled cavities

in the belt" (C9, L55) which is understood to mean that the volume defined by said cavity is filled with the dispersion or alternatively that the volume of mixture solution in the mixture volume equals the cell sheet volume as claimed.

As correctly pointed out by Applicant in response to the Office Action dated July 18, 2006, Berg teaches that "it is preferred that a sufficient amount of volatile component be removed from the dispersion so that the precursors of the abrasive particles can be easily removed from the cavities of the mold. Typically, up to 40% of the liquid is removed from the dispersion in this step." (column 7, lines 20-25) From this statement, it is clear that under typical processing conditions Berg teaches ejecting a dispersion form the cell sheet which contains an appreciable amount (at least 60%) of the initial water content as set forth above. Further where Berg teaches a most preferred initial liquid mixture containing 50-60% volatile (e.g. water) then even after removal of 40% of the water, the liquid mixture volumes still contain nearly 30% water by weight ((0.40*0.5 volatile)/[(0.40*0.5 volatile)+(0.5 solids)]=0.28). Since an appreciable amount of water remains in the ejected volumes, it is therefore clear from the Berg teachings that under typical processing conditions, the "liquid mixture volumes" are ejected from the cell sheet as claimed.

4. "removing the precursors of the abrasive particles from the mold cavities…by applying a low pressure to force them out of the cavities" (C7,

L26-34). With respect to the immediate claim, the "precursors of the abrasive particles" are held equivalent to the claimed "mixture volume" before removal from the mold and to the "mixture solution lump entities" after removal from the mold. Additionally the described applied pressure force is interpreted as being equivalent the claimed "impinging jet of fluid" used to dislocate the mixture volumes from the mold.

5. Berg further indicates that "when the precursors of the abrasive particles are removed from the mold, some of their edges may...become rounded" (C7, L40-43). This rounding effect or deformation of the precursors of the abrasive particles in the extreme case would produce an approximately spherical body and is understood to inherently occur from a force such as surface tension acting upon the body of said particle. Although presented in the immediate reference as a situation to be avoided or minimized, this disclosure is nevertheless read on the immediate claim as shaping the mixture solution lump entities into independent spherical entities through a force acting upon said lump entities.

Evidence of the inherent impact of surface tension upon slurries in the above solids concentration range has recently been reported by Zhai et. al. (Materials Science and Engineering A, Vol 392(1-2), 15 Feb 2005, Pg 1-7). The Zhai and Berg dispersions

would be recognized by skilled artisans as very closely related mixtures. Specifically, both mixtures are aqueous suspensions of alumina powers of average particle diameter in the approximate size range of 0.5 to 1.0 micron and of total solids content in the range of 40-50% by mass. Although the identities of the trace compounds utilized as binders and pH control additives differ between the two mixtures, it is evident that the major constituents of each mixture are closely related by both physical properties and composition.

Now the Zhai reference shows (see table 2) that the very similar, albeit not identical, slurry dispersion to that disclosed by Berg, and having up to 70% solids concentration by weight, maintain sufficient fluidity to by shaped into spherical particles by the effects of surface tension. Therefore, even after removal of 40% of the water from the initial slurry composition (as set forth in the suggested operating protocol by Berg), the Zhai reference shows that the remaining liquid mixture element comprising approximately 70% solids would be subject to spherical rounding by surface tension forces.

In addition to the rounding of non-spherical particles, Berg clearly demonstrates the formation of "Circular" particles in the instant Fig 6. Further and more importantly, Berg teaches that "the (mold) cavity may be the inverse of even other solid geometric shapes, such as, for example, pyramidal, frusto-pyramidal, <u>truncated spherical, truncated spheroidal,</u> conical, and frusto-conical" (Column 6, lines 35-47). In accord with the broadest reasonable interpretation of the term "spherical" in the instant claim

language, Bergs formation of truncated spherical particles anticipates applicants formation of "independent spherical entities"

6. "Typically, the precursors of the abrasive particles will be dried (outside of the mold" (C7, L46-58) which is held equivalent to the claimed process of subjecting the independent spherical entities to a "solidification environment" to form "loose green beads". Further by the above rationale, Berg teaches the formation of "spherical beads".

7. Finally, it is indicated that the precursors of the abrasive particles are sintered to form the abrasive particles (C8, L8-10) which is understood to read on the claimed process of firing the loose green beads at high temperature to form the beads.

With respect to Claim 3, Berg indicates that the precursors of the abrasive particles are to be exposed to elevated temperature air in an "air circulating oven" (C9, L56). The above disclosure is read as equivalent to providing a solidification environment comprising elevated temperature air or other gas.

Regarding Claim 6, the immediate reference indicates (C6, L8) that the mold can be made from a "belt" which is understood to be equivalent to the claimed cell sheet

wherein the two opposing ends of said sheet are joined to form a cell sheet continuous belt.

Concerning Claim 8, Berg indicates in a calcining step that the precursors of the abrasive particles are "generally heated to a temperature of from about 400°C to about 800°C" (C7, L64-65). This step is followed by sintering the precursors to form the abrasive particles wherein said sintering step occurs in a temperature range from about 1000°C to about 1650°C (C8, L8-24). The applicant indicates in the specification that;

> "Vitrification of the composite agglomerate or granule is avoided as the external surface of the composite would change into a continuous glassy state, thereby preventing the composite from having a porous external surface. Some example abrasive agglomerates using Aluminum oxide abrasive particles were fired at 700 degrees C. which produced a smooth, shiny agglomerate surface finish." (pg 10, ¶[0049])

It is therefore understood that the disclosed heating temperatures in the calcining and sintering of the aluminum oxide particles as set forth by Berg are "sufficiently high to vitrify the bead exterior surface" and thereby producing glassy surfaces on the surface of the beads.

Claim 11 is anticipated by the combined rejections of Claim 1 and Claim 8 under 35 USC 102(b) above.

Claim 12 is anticipated by Berg in light of the rejection of Claim 11 and the argument set forth in the rejection of Claim 3 as presented above.

Claim 15 is anticipated by Berg in light of the rejection of Claim 11 and the argument set forth in the rejection of Claim 6 as presented above.

Claim 17 is anticipated by Berg in light of the rejection of Claim 11 and the argument set forth in the rejection of Claim 8 as presented above.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims 4 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Berg (5,984,988) in view of Howard (3,916,584).

Berg is discussed above with respect to Claims 2 and 11. Berg does not disclose the use of dehydrating liquid. As the applicant indicates in the body of the

specification, the use of a dehydrating liquid in the processing of abrasive beads is commonly practiced and well known in the art;

> "Presently there are a number of methods used to manufacture abrasive beads...Among the earliest processes of making beads is a process developed by Howard in U.S. Pat. No. 3,916,584 where he *poured a slurry mixture* (of abrasive particles mixed in a Ludox® solution of colloidal silica suspended in water) *into a dehydrating liquid* including various alcohols or alcohol mixtures or heated oils including peanut oil, mineral oil or silicone oil and stirred it." (Pg 6, ¶ [0022])

It would have been an obvious alteration for one of ordinary skill in the art at the time of the invention to incorporate the old and well know "dehydrating liquid" process as taught by Howard to the abrasive particle manufacture process as taught by Berg. This would be an obvious modification to the Berg process in order to prevent the ejected mixture lump solution entities or independent spherical entities from agglomerating into a larger mass during while being subjected to the solidification environment.

<u>Claims 5 and 14</u> are rejected under 35 U.S.C. 103(a) as being unpatentable over Berg (5,984,988) in view of Eisenberg (4,393,021).

Berg teaches the formation of cavities in a mold belt as previously indicated and that "the cavities can extend completely through the belt, such that the belt has a multiplicity of perforations therein" (C9, L33-34), However, the immediate reference makes no indication that said belt or "cell sheet" should be a woven screen. Eisenberg teaches the fabrication of abrasive grits by pressing or extruding a composite of

abrasive grits with a binding medium through a mesh screen (C2, L42-46) or "endless sieve web" (C3, L12). It would be obvious to one of ordinary skill in the art attempting to reduce equipment fabrication costs associated with manufacturing a machined mold in the manner taught by Berg to substitute an "endless sieve web" or woven screen for said mold belt as taught by Eisenberg.

Claims 7 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Berg (5,984,988) in light of Culler (6,521,004) and the Quadro Engineering Incorporated Quadro® Comil® product description (http://www.quadro.com/3_milling/3_applications.asp).

Berg teaches of a belt shaped mold device for use in the manufacture of agglomerate abrasive particles. The immediate reference however fails to explicitly indicate that the mold should take the form of a disk shape having an annular pattern of cell sheet holes. Culler teaches of a perforated substrate (see Fig 4 excerpt below), broadly understood to be of a conical disk shape and presenting an annular pattern of cell sheet holes. Further by Cullers teachings, this perforated substrate is utilized in the fabrication of abrasive agglomerate particles. The particular apparatus presented by Culler is manufactured by Quadro Engineering Incorporated and is reported by said manufacturer to minimize blockages in the screen or perforations.

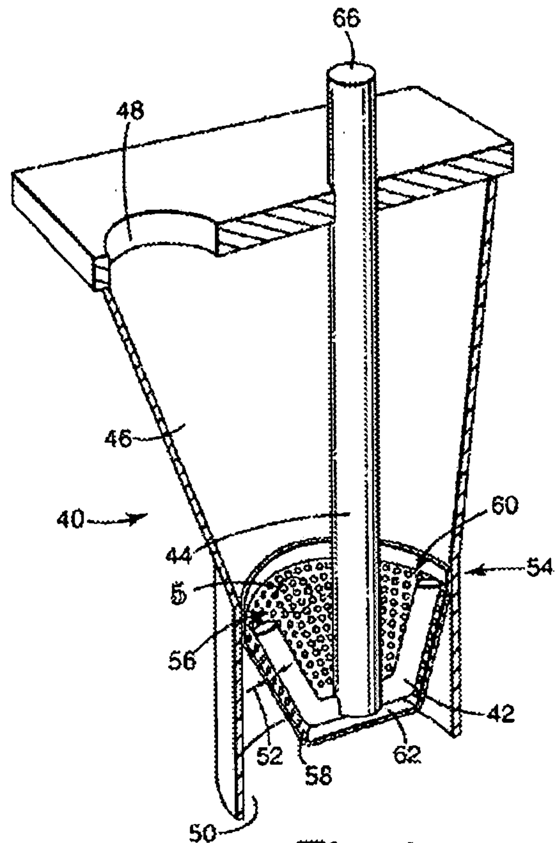

Fig. 4

It would be obvious to one of ordinary skill in the art to modify belt shaped mold taught by Berg with the disk shaped mold and impeller as taught by Culler. The aforementioned modification would be an obvious extension to the Berg process to one seeking to increase equipment operating time by minimizing cell sheet hole or screen blockages.

Claims 9 and 10 rejected under 35 U.S.C. 103(a) as being unpatentable over Berg (5,984,988) in view of Matthews (3,838,998).

Specifically with respect to Claim 9, Berg discloses all of the elements of Claim 2 while failing to explicitly indicate that a "chemical agent" selected from the presented group should be incorporated into the mixture solution to provide spherical shaped hollow beads. Matthews teaches of a process incorporating both high and low temperature glass formers in an admix with water to form a slurry. Upon performing a dual heating cycle first at low temp which bloats the low temp glass former and then at high temperature which vitrifies the outer shell, Matthews prepares a hollow, spherical, and vitrified particle. In the instant case, the "admix" could be considered a "hollow sphere forming mixture" which provides for hollow particles. Matthews further indicates that "hollow microspheres are particularly advantageous as they contribute stiffness and strength yet often permit a reduction in weight of the ultimate product because of their stiffness and strength in proportion to their density" (C1, L26-31). It would be obvious to one of ordinary skill in the art seeking to prepare a hollow abrasive particle to incorporate a low temperature glass former into the mixture volume according to the teachings of Matthews into the process as outlined by Berg. The preparation of a hollow abrasive of the type taught by the Berg-Matthews combination would be obvious to one seeking to retain the stiffness and abrasive properties of the abrasive particles while minimizing the particle density and therefore product weight.

Regarding Claim 10 and in light of the Claim 9 Rejection above, Berg indicates that the calcinated precursor particles are to be subjected to a temperature sufficient to

sinter the particles as outlined in Claim 2 above. This disclosure is read in the immediate claim as firing the hollow beads at a temperature sufficiently high to vitrify the agglomerate exterior surfaces of said beads thereby resulting in glassy surfaces on said vitrified beads.

Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Berg (5,984,988) as applied to Claim 11 and in further view of Cai et. al. (Phys Rev Lett. 2002 Dec 2;89(23):235501.)

Specifically, Berg sets forth the composition of the dispersion as "containing particles that can be converted into alpha alumina in a liquid" while failing to explicitly indicate the said dispersion should necessarily contain at least one material from the indicated group. Cai indicates that "gamma-alumina is known to transform to theta-alumina and finally to alpha-alumina upon thermal treatment". It would therefore be obvious to one of ordinary skill to choose gamma-alumina as taught by Cai or "alumina" from the immediate list for the particle that can be converted into alpha alumina in the thermal treatment process set forth by Berg.

Claims 19 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Berg (5,984,988) as applied to Claim 11 above and in further view of Culler (6,521,004).

With respect to Claim 19 and as indicated above, Berg teaches all of the elements of Claim 11 as well as indicating that, "the shaped particles of (the Berg)

invention continually fracture to expose fresh cutting surfaces" (C3, L42-44). Accordingly, they may be considered in the present context to be an erodible matrix material. Berg further indicates that said abrasive particles can be combined with cubic boron nitride or diamond in an adhesive coating layer when preparing an abrasive article (C11, L10-20). Berg however fails to indicate that diamond or cubic boron nitride particles should be directly incorporated into the spherical abrasive agglomerates and bound in an erodible matrix material. Culler teaches a method of forming abrasive agglomerate particles by encapsulating abrasive grains in an erodible binder agent. Among the acceptable abrasive grains indicated as being preferred for the immediate process include aluminum oxide, diamond, and cubic boron nitride (C2, L1-12). It is further indicated that incorporating said abrasive grains in the erodible matrix enhances the useful life of a coated abrasive article (C1, L29-31). It would therefore be obvious to one of ordinary skill in the art seeking to enhance the useful life of an abrasive article to directly incorporate oxides, cubic boron nitride or diamond directly into the erodible matrix material or the shaped particles of the Berg invention according to the teachings of Culler.

Regarding Claim 20, Berg indicates that "the thickness of the particles preferably range from about 25 micrometers to 500 micrometers" (C11, L5-7) and that they may further have an aspect ratio of 1:1 with respect to their thickness (C3, L34-38). This disclosure is understood as providing abrasive agglomerates having number average abrasive particle diameter sizes in the range of about 25 to 500 micrometers. This disclosure alone is understood as providing abrasive agglomerates in the approximate

size range of 10 micrometers as indicated in the immediate claim limitation. As further indicated above in the Claim 19 rejection, Berg indicates that the abrasive agglomerates can be encapsulated with aluminum oxide or "oxide materials" and an adhesive to form an erodible composite film on an abrasive article. Berg fails to *explicitly* set forth that the abrasive agglomerates should have diameters less than 10 micrometers or that the erodible composite should be in the form of particles with diameter of less than 60 micrometers.

Culler teaches that the erodible agglomerate particles, discussed in the rejection of Claim 19 above, have a length dimension in the range of about 10 to about 1500 micrometers (C20, L43-46) and consist principally of abrasive particles in an erodible binder. This disclosure is understood to provide for erodible agglomerate particles overlapping with the size range of 20 to 60 micrometers as set forth in the immediate claim. Further, since the erodible agglomerate dimension must be equal to or larger than the abrasive particle constituents, said abrasive particles must be of a size range less than or equal to 10 micrometers for erodible agglomerate particles on the lower end of the size range. Given that Culler sets forth abrasive particle dimensions and erodible abrasive agglomerate dimensions in the range of the immediately claimed invention, said dimensions are considered to be routinely employed in the art. It would therefore be obvious to adapt Berg process to produce abrasive agglomerates and erodible composite agglomerates in the size range taught by Culler as appropriate for the end user application

Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Berg (5,984,988) as applied to Claim 11 above and in further view of Ramanath (5834,569).

Berg teaches all of the elements of Claim 11 while failing to indicate that coloring agents should be incorporated into the abrasive agglomerates in order to identify the particle size of the abrasive particles contained in said abrasive agglomerate. Ramanath teaches a grinding wheel "can be colored according to a predetermined color coding scheme to identify particle size, shape and type of abrasive" (C2, L31-33). It would therefore be obvious to one of ordinary skill in the art to incorporate a color-coding scheme as taught by Ramanath to abrasive particles of the Berg process in order to prevent the use of an incorrect abrasive particle size.

(10) Response to Argument

Applicants arguments have been carefully considered with respect to the claim rejections under 35 U.S.C. 102(b) and under 35 U.S.C. 103(a), however they have been found unpersuasive.

Since the teachings of Berg (US 5,984,988) as evidenced by Zhai et. al. is central to each of the contested art rejections, the key findings set forth by Berg and the resulting basis for the art rejection of claims under 35 U.S.C. 102(b) are here summarized. In short, Berg teaches;

1) a mold or cell sheet having an array of through holes and each hole having a cross sectional area and a "nominal thickness"

2) A dispersion is prepared comprising a liquid solution of inorganic oxides and water to prepare a liquid solution

3) The array of through holes is filled with the liquid solution to form entrained mixture volumes

4) A portion of the liquid is evaporated from the entrained dispersion, however even in the most extreme scenario presented by Berg the mixture volumes still contain approximately 30% water by weight. Since liquid water was initially added to the inorganic powder to form the mixture volumes, said mixture volumes would be rightfully construed as "liquid mixture volumes". Similarly, since water remains in the mixture volumes after this partial dehydration step, the partially dehydrated mixture volumes are likewise considered, in the broadest reasonable interpretation of the term, to be "liquid mixture volumes".

5) These liquid mixture volumes are ejected from the cell sheet by application of a pressure or an "impinging jet".

6) Berg discloses that after ejection "some of the edges may become rounded". In the absence of any compelling evidence to the contrary, it is the Examiners position that this rounding effect occurs at least in part due to surface tension forces. In combination with the Berg teaching of truncated spherical or truncated spheroidal geometries for the particles, the Berg process is understood to provide for ejected, independent liquid mixture solution entities having a spherical shape which are subject to surface tension forces.

7) The entities are dried outside of the mold or equivalently subjected to a solidification environment

8) The dried entities are ultimately subjected to a sintering process to produce sintered beads.

The reference to Zhai is pointed to in this rejection simply to provide supporting evidence that high solids (e.g. up to 70% by mass alumina in water) content slurries of very closely related, albeit not identical composition, are subject to deformation by surface tension forces. Restated, the rejection as presented does not turn upon the disclosure provided by Zhai, however said reference does provide further supporting evidence for the action of surface tension upon the ejected "liquid mixture volumes".

Now although each of Applicants submitted arguments will be addressed in detail in the following discussion, it is the Examiners understanding that Applicants arguments against the applicability of Berg relate primarily to the following key issues;

1) Is the mixture volume ejected from the mold cell in the Berg process appropriately construed as a "liquid mixture volume".
2) Does Berg teach the formation of particles which may be appropriately construed as "independent spherical entities".
3) Is it reasonable to conclude that that the particle edge "rounding" phenomenon described by Berg is due at least in part to "surface tension forces" acting upon the ejected mixture volumes.
4) Is the Zhai aqueous alumina suspension, which is disclosed as being subject reshaping by surface tension forces, sufficiently similar to the Berg aqueous alumina suspension such that one would expect similar surface tension reshaping behavior in the Berg mixture.

Rejection of Claims 2, 3, 6, 8, 11, 12, 15, and 17 under §102(b) over Berg (US 5,984,988);

Argument #1)

Applicant alleges (pages 14-17) that the volume of material ejected from the mold in the Berg reference can not under any circumstances be construed as a "liquid

mixture volume". This argument relates particularly to independent claim 2, lines 14-17 and independent claim 11, lines 15-19 which require in part that a "liquid mixture volume" is ejected from the "cell sheet holes".

Applicant acknowledges that the volume of material retained within Berg the "cell sheet holes" after a partial dehydration step retain at least 30% by weight of water in the material, however applicant asserts that this mixture can not be construed as 30% liquid.

In support of this argument, Applicant points to Gelatin and hydrated salts as examples of materials which comprise significant fractions of water but which would not be considered liquids. From this line of reasoning, Applicant concludes that since all materials containing 30% by mass water do not behave as liquids then the Berg ejected volumes can not be considered as liquid mixture volumes. Applicant further points to figure 9 of Berg which teaches a step of grinding the particles. Applicant thereby concludes that Berg "clearly treats his particles as solids" and therefore "there is no room for reinterpretation" of said particles as a liquid.

Applicant asserts that in accordance with the claim language, "a liquid must be expelled, not merely a solid containing a component which, under certain temperature conditions, would be a liquid (water)". From the foregoing, Applicant concludes that "the Berg particles are not liquid, whatever their liquid content".

Applicants arguments on this matter are held to be unpersuasive.

In response to this argument, it is noted that Applicant repeatedly asserts that "a liquid must be expelled" from the cell sheet and that "the Berg particles are not liquid". Applicants claim language however requires only that the ejected volumes be "liquid mixture volumes". Therefore, the question at hand is not whether the Berg particles constitute a liquid but whether said particles constitute a "liquid mixture".

Thus in response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., That the ejected volumes are a "liquid") are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Further, it is the Examiners position that the cell sheet ejected volumes disclosed in the Berg reference are properly construed as the claimed "liquid mixture volumes". Specifically, in the formation of the Berg particles, liquid water was initially added to an inorganic powder to form a slurry which upon transfer to the cell sheet holes forms the claimed "mixture volumes". Such a mixture or slurry, formed with a liquid as at least one constituent, would be rightfully construed as a "liquid mixture".

As acknowledged by Applicant, water remains in the Berg mixture volumes after transferring the mixture to the cell sheet holes and after partially dehydrating the mixture

within the cell sheet holes. Since the partially dehydrated mixture volumes retain at least a portion of the original, constitutive liquid, said partially dehydrated mixture volumes are likewise rightfully construed as "liquid mixture volumes" in accordance with the broadest reasonable interpretation of the term.

Argument #2)

Applicant argues (pages 17-20) that although Berg teaches the formation of several geometric shapes including *inter alia* truncated spherical and truncated spheroidal, none of the thus disclosed particle shapes can be properly construed as "independent spherical entities" and that to do so represents a "misinterpretation of the word spherical". In support of this position Applicant argues (pages 17-18) that Berg "can not machine-form a spherical cavity inside a thin sheet". Applicant further asserts that in order to enable functionality for the Berg process, the prior art particles must be solidified prior to removal from the cavities. Restated, Applicant asserts that since none of the mold cavity geometries taught in the Berg reference are spherical and since the particles are "solidified" prior to ejection from the mold, then the prior art teachings necessarily exclude the formation of a spherical particle.

Applicants argument on this matter is found unpersuasive

In response, it is first noted that the mold cell utilized in Applicants apparatus like that of Berg does not teach the use of a "spherical" mold cavity, nevertheless Applicant

claims that spherical entities are formed therefrom. It would therefore be reasonable to conclude that cavity shape is substantially immaterial to the formation of spherical particles when a particle is subject to deformation forces after being ejected from the mold cavity.

Further, the Examiner does not agree with Applicants allegation that in order for the Berg process to be enabled, "the ejected particles ..(must) retain the same shape they had as they resided within the cavities" (page 18). This allegation is in direct contrast with the Berg disclosure which teaches that the edges of the particles may become rounded after ejection from the mold.

Next, Applicants cited supporting passage from Berg (column 7, lines 45ff) states that the precursors to the abrasive particles have “approximately”, not identically, the same shape as the mold cavity. And as discussed above, Berg teaches that the edges of the ejected mixtures may become rounded after ejection from the cell cavity. It follows that since the precursors need only “approximate” the shape of the mold cavity and since the Berg particles are subject to “rounding” after ejection, then Applicant has no basis to categorically conclude that Berg is excluded from forming substantially spherical particles or ‘independent spherical entities’ as claimed.

Next, Applicant postulates that “Berg’s rounding is simply meant to break-off a sharp edge as in to round it off” (see page 19). The Examiner has found no basis in the prior art reference to substantiate this allegation and Applicant has provided no

evidence in support thereof.

It has been shown that the Berg particles need only approximate the geometry of the cell and that after ejection from the mold cell the particles are subject to a rounding effect. In the absence of any compelling evidence to support Applicants allegations, namely that Berg can not form substantially spherical particles, said arguments are treated as unsubstantiated attorney argument. The MPEP §2144.09 provides unambiguous guidance to this end stating in part that "The arguments of counsel cannot take the place of evidence in the record. In re Schulze,346 F.2d 600, 602, 145 USPQ 716, 718 (CCPA 1965); In re Geisler, 116 F.3d 1465,43 USPQ2d 1362 (Fed. Cir. 1997).

Argument #3)

Applicant argues at length (Pages 21-36) that Zhai can not be relied as supporting evidence to show that the edge "rounding" effect noted by Berg is reasonably due at least in part to the action of surface tension forces. Applicant specifically argues that the composition of the Berg and Zhai are completely different and that the behavior of one mixture does not translate to the other.

In support of this position, Applicant cites multiple non-patent literature references including;

- Summers et al. (page 22)
- Calvert et. al. (Page 23)
- Duget et. al. (page 23)

- Ayers et. al. (page 24)
- Gelb et. al (page 24)
- Sternowdky et al. (page 31)

Not one of the aforementioned evidentiary references has been previously made of record, nor has Applicant provided copies of the relevant sections of these references as evidence in the instant appeal brief. The official policy regarding submission of evidence in an appeal brief is set forth in the MPEP §1205[R-3] which requires in part that, "If in his or her brief, appellant relies on some reference, he or she is expected to provide the Board with **>a copy of it in the evidence appendix of the brief<". Further MPEP section §1205.02 states that "Reference to unentered evidence is not permitted in the brief. See 37 CFR 41.33 for treatment of evidence submitted after appeal."

It follows that Applicants arguments purporting distinctions between the Zhai and Berg particles which rely upon evidence which has not been appropriately made of record are deemed moot.

This point not withstanding, it is the Examiners position that the Zhai and Berg mixtures are in fact substantially similar, albeit not identical, and that one of ordinary skill would reasonably expect similar behavior between the two. In support of this position, it may prove instructive to compare the principle components of each of the Berg and Zhai mixtures.

Berg Mixture

- Particles of aluminum oxide (boehmite) [C4,L54-C5,L18] – most preferably 40-50% weight solids and preferably 50-60% volatiles
- "the dispersion may contain a modifying additive or precursor of a modifying additive…can be in the form of soluble salts, preferably water soluble salts. Typically, the introduction of a modifying additive or precursor of a modifying additive will cause the dispersion to gel." (e.g. binder, dispersant, etc.) [C5, L23 - C5, L67]
- Approximate particle size of about 1 micron – Dispersal™ boehmite

Zhai Mixture

- mixture of 97% aluminum oxide powder along with minor mass fraction of dispersant, binder, and antifoam agent was added to water to yield a total solids mass fraction of 40-70% (Page 2, §2.2)
- a macromolecular organic compound, "A15", is added as a dispersant, along with polyvinyl alcohol (PVA) and n-butanol as binder and antifoam agents, respectively. (Page 2, §2.2)
- Control over pH is enacted in order to promote "better colloid characteristic" – (Page 3, §3.1)
- Approximate alumina particle size 0.6 microns typical range of 0.3 to 1.0 micron – (Page 2, §2.1)

It is evident from the foregoing that the Zhai and Berg mixtures are substantially, albeit not absolutely, identical in their composition. Specifically, both mixtures are aqueous suspensions of alumina oxide powder having an average particle diameter in the range of approximately 0.5 to 1.0 micron and having a total solids content in the range of 40-50% by mass. Both utilize binders as minor mass fraction constituents and both exercise control over solution pH in order to control colloidal characteristics. Therefore given their substantial similarities, it is reasonable to conclude that the surface tension forces which act to reshape the Zhai mixture would be expected to

likewise affect the closely related aqueous alumina suspension utilized in the Berg reference.

As noted in the response to previous arguments above, the fact that the Berg particles undergo a reshaping phenomena is expressly disclosed by Berg and is not here in question. Now to summarize the foregoing; the Office has provided a reasoned basis along with evidentiary support which would lead one to conclude that the Berg particles undergo reshaping by the effect of surface tension forces. By contrast, although Applicant repeatedly argues that the ejected Berg mixture volumes can not undergo reshaping outside of the mold and that the Berg mixtures are not subject to surface tension forces, Applicant has provided no evidence to support this assertion.

The burden of proof rests with Applicant to provide evidence of record explicitly showing that the Berg particles are not subject to reshaping by surface tension forces. To this end, the MPEP §2112 states;

> "[T]he PTO can require an applicant to prove that the prior art products do not necessarily or inherently possess the characteristics of his [or her] claimed product. Whether the rejection is based on inherency' under 35 U.S.C. 102, on prima facie obviousness' under 35 U.S.C. 103, jointly or alternatively, the burden of proof is the same...[footnote omitted]." The burden of proof is similar to that required with respect to product-by-

process claims. In re Fitzgerald, 619 F.2d 67, 70, 205 USPQ 594, 596 (CCPA 1980) (quoting In re Best, 562 F.2d 1252, 1255, 195 USPQ 430, 433-34 (CCPA 1977)).

It is the Examiners position that the Applicant has failed to meet this burden.

Rejection of Claims 4 and 13 under §103(a) over Berg (US 5,984,988) in view of Howard (3,916,584);

Applicant argues that the rejection of claims 4 and 13 are in error for the same reason as the rejection of claims 2 and 11 above. Applicant asserts that Howard does not address the deficiencies of Berg but adds no additional arguments related to the instant rejection.

Rejection of Claims 5 and 14 under §103(a) over Berg (US 5,984,988) in view of Eisenberg (US 4,393,021)

Applicant alleges that Eisenberg can not be combined with Berg without destroying the objectives of Berg. Specifically Applicant argues that the adjacent cell volumes in the wire screen utilized by Eisenberg are contiguous. Applicant concludes that upon shrinkage, the particles would pull themselves apart from each other at the screen joints" and that "the entities will remain lodged in the screen mesh".

Applicants arguments on this matter are held to be unpersuasive.

In response, Applicant has provided no evidence of record which would tend to support the instant allegation, namely that combination of the Eisenberg and Berg disclosures would "destroy the objective of Berg". Further, the Examiner has been unable to find any evidence in either of the cited references which supports Applicants alleged system behavior (e.g. that the particles would pull apart from each other and/or remain lodged in the screen).

In the absence of any compelling evidence to support Applicants allegations, said arguments are treated as unsubstantiated attorney argument.

Rejection of Claims 7 and 16 under §103(a) over Berg (US 5,984,988) in view of Culler (US 6,521,004)

In addition to asserting that Culler does not remedy the deficiencies of Berg with respect to claims 2 and 11, Applicant alleges that it would not be obvious to substitute the cone screen of Culler for the belt mold of Berg. Applicant points to distinctions between the disclosed methods and concludes that one of ordinary skill would not find it obvious to combine the teachings.

Applicants arguments on this matter are held unpersuasive.

In the Final Office Action Culler was cited strictly as a known, alternate mold geometry to screens for use in the fabrication of abrasive particles. Culler explicitly notes that the disclosed cone mold provides the advantage of minimizing mold blockages. It was noted in the final rejection that substitution of the cone mold for the Berg belt mold would have represented an obvious extension for "one seeking to increase equipment operating time by minimizing cell sheet hole or screen blockages". With respect to the prior art combination, Applicant has provided substantially no arguments to rebut the provided motivation to combine the references.

Rejection of Claims 9 and 10 under §103(a) over Berg (US 5,984,988) in view of Matthew (US 3,838,998)

Applicant argues that the disclosure of Matthew teaches away from a combination with the Berg reference. Specifically, Applicant asserts that Berg teaches the formation of solid particles while Matthew teaches the formation of hollow particles. Applicant then postulates that Berg requires the particles to shrink in order to eject them from the mold, and Applicant concludes that addition of the Matthew bloating agent to said particles "would prevent the beads from being ejected from the Berg mold".

Applicant's arguments on this matter are held to be unpersuasive.

In response, Applicant has provided no evidence of record which would tend to support the instant allegation, namely that combination of the Matthew and Berg disclosures would result the inability to eject the Berg particles from the mold. Further,

the Examiner has been unable to find any evidence in either of the cited references which supports Applicants alleged behavior.

Attorney argument is not a substitute for evidence. In the absence of any compelling evidence to support Applicants allegations, said arguments are treated as unsubstantiated attorney argument and thus deemed moot.

Rejection of Claim 18 under §103(a) over Berg (US 5,984,988) in view of Cai (Phys. Rev. Lett. 2002 Dec 2;89(23):235501;

Applicant argues that the rejection of claim 18 is in error for the same reason as the rejection of claims 2 and 11 above. Applicant asserts that Cai does not address the deficiencies of Berg but adds no additional arguments related to the instant rejection.

Rejection of Claims 19 and 20 under §103(a) over Berg (US 5,984,988) in view of Culler (6,521,004);

Applicant argues that the rejection of claims 19 and 20 are in error for the same reason as the rejection of claims 2 and 11 above. Applicant asserts that Culler does not address the deficiencies of Berg but adds no additional arguments related to the instant rejection.

Rejection of Claim 21 under §103(a) over Berg (US 5,984,988) in view of Ramanath (5,834,569);

Applicant argues that the rejection of claim 21 is in error for the same reason as the rejection of claims 2 and 11 above. Applicant asserts that Howard does not address the deficiencies of Berg but adds no additional arguments related to the instant rejection.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Jason L. Lazorcik

Conferees:

Steven P. Griffin FOR S. GRIFFIN

/Romulo H. Delmendo/

Romulo H. Delmendo, Appeal Conferee